State of North Carolina
Cooperating Technical State
Mapping Activity Statement

Agreement A—Project Scoping for Six Eastern River Basins

In accordance with the Cooperating Technical State (CTS) Memorandum of Agreement dated September 15, 2000, between the State of North Carolina and the Federal Emergency Management Agency (FEMA), Mapping Activity Statement A is as follows:

1. **Objective and Scope:** The objective of this Mapping Activity is for the State, with support from FEMA, to determine the scope of needed flood map updates for counties and communities in the six eastern river basins (Lumber, Cape Fear, White Oak, Neuse, Tar-Pamlico, and Pasquotank) of North Carolina. Based on the results of this scoping, updated flood data will be developed and Digital Flood Insurance Rate Maps (DFIRMs) produced for the affected counties and communities in accordance with Mapping Activity Statement Agreement E. This activity will build on the data collected by the State as part of the "Assessment of Community Mapping Needs" Mapping Activity Statement signed in September 1999.

2. **Period of Performance:** This Mapping Activity began in August 2000 and will be completed by May 30, 2001. This Mapping Activity may be terminated at the option of FEMA or the State of North Carolina in accordance with the provisions of the September 15, 2000, CTS Memorandum of Agreement.

3. **Funding/Cost-Sharing:** Funding will be in accordance with CTS Funding Agreement No. 1.

4. **Standards:** The scoping will be conducted following the approach outlined in Attachment A, "North Carolina Flood Mapping Program, Approach for Scoping for the Six Eastern River Basins," dated October 16, 2000.

5. **Products:** This activity will result in a North Carolina Scoping Database summarizing the results of the initial research, community questionnaire responses, and initial scoping meetings.

   This information will be used to produce basin plans for each basin that include the following:

- Identification of flooding sources requiring flood data updates, including reach limits and type of update (e.g., approximate study, detailed study, redelineation of floodplain boundaries, or coastal).

- Identification of counties and incorporated communities for which new and/or updated DFIRMs will be prepared using the updated flood hazard data.

- This information from the basin plans will be used for Mapping Activity Statement E, "Updated Flood Hazard Data and DFIRM Production for the Six Eastern Basins."

6. **Schedule and Milestones:** The following target schedule is anticipated for compleing the final basin plans:

River Basin	Final Basin Plans
White Oak	February 1, 2001
Lumber	February 8, 2001
Tar Pamlico	February 20, 2001
Cape Fear	March 20, 2001
Neuse	April 5, 2001
Pasquotank	April 30, 2001

7. **Technical Assistance and Resources:** FEMA, through its Mapping Coordination Contractor, Dewberry & Davis LLC (MCC-D&D), will work with the North Carolina Division of Emergency Management to conduct the research of FEMA archives and evaluate post-Hurricane Floyd data. The MCC-D&D will also develop the North Carolina Scoping Database and populate it with information. Additionally, the MCC-D&D will provide support in conducting the initial and final scoping meetings and drafting the basin plans.

8. **Contractors:** Contractors may be utilized by the State of North Carolina for this activity. Procurement of contractors using Federal funds provided as part of this Mapping Activity will comply with the requirements of 44 CFR 13.36.

9. **Reporting:** Periodic reporting will be provided to the CTS Committee by the State of North Carolina for the purpose of review and approval.

10. **Points of Contact:** The FEMA Project Manager is Laura Algeo, and the CTS Program Director is John Dorman or subsequent personnel of comparable experience who are appointed to fulfill these responsibilities.

Each party has caused this Mapping Activity Statement to be executed by its duly authorized representatives.

John K. Dorman, Program Director
North Carolina Office of State Budget, Planning, and Management

1-9-01
Date

Laura Algeo, Project Manager
Federal Emergency Management Agency

1-9-01
Date

Doug Bellomo, Project Officer
Federal Emergency Management Agency

1-9-01
Date

State of North Carolina
Cooperating Technical State
Mapping Activity Statement

Agreement B—Information Management System

In accordance with the Cooperating Technical State (CTS) Memorandum of Agreement dated September 15, 2000, between the State of North Carolina and the Federal Management Agency (FEMA), Agreement B is as follows:

1. **Objective and Scope:** The objective of this Mapping Activity is to design, develop, and implement a dynamic, state-of-the-art Information Technology (IT) infrastructure to maintain, archive, and disseminate flood maps and associated data for the North Carolina Flood Mapping Program. This system will also present and distribute the mapping data, associated reports, and other Framework data layers to the public via the Internet. The data to be presented and distributed will include the Digital Elevation Models, engineering analyses and models, base maps, Digital Flood Insurance Rate Maps (DFIRMs), study reports, and other related documents. The system will be a Web-based interactive system whose data can be integrated into the Statewide Technical Architecture, North Carolina Corporate Geographic Database, and, to the extent practicable, existing and planned FEMA IT systems.

   The development of this system will entail the following tasks:
   - Conducting a requirements analysis
   - Developing a preliminary system and database design and work plan
   - Completing a final system design
   - Developing the system
   - Testing the system
   - Implementing the system

   The requirements analysis will entail conducting interviews with all signatories to this Agreement, as well as other end user groups, to derive the functional, qualitative, and technical requirements for the system.

2. **Period of Performance:** This Mapping Activity will begin December 1, 2000, and end by September 30, 2001. This Mapping Activity may be terminated at the option of FEMA or the State of North Carolina in accordance with the provisions of the September 15, 2000, and August 2000 CTS Memoranda of Agreement.

3. **Funding/Cost-Sharing:** Funding will be in accordance with CTS Funding Agreement No. 1.

4. **Contractors:** Contractors may be used by the State of North Carolina to assist in the completion of the activity associated with this agreement. Procurement of subcontractors using Federal funds provided as part of this Mapping Activity will comply with the requirements of 44 CFR 13.36.

5. **Technical Assistance and Resources:**

   All Federal agency signatories to the September 15, 2000, Memorandum of Agreement will be contacted to solicit technical expertise and assistance to the State of North Carolina regarding the most efficient and/or innovative approaches necessary to collect, manage, and disseminate program data and maps for Web-based server dissemination. Where possible, input will be solicited through surveys and interviews during the requirements analysis and through reviews and comments on the draft and final Requirements Analysis documents.

   FEMA will provide the State of North Carolina any new or updated guidelines, standards, and requirements associated with both contract work and programmatic direction.

6. **Standards:** The following standards and resource documents are relevant to the development and evaluation of the DFIRM dissemination and this Mapping Activity:
   - *Digital Flood Insurance Rate Map (DFIRM) Graphic Specifications.*
   - Standard DFIRM spatial database product description.
   - *Content Standards for Digital Geospatial Metadata* (Federal Geographic Data Committee, 1998).
   - *OpenGIS Web Server Specifications* (Open GIS Consortium).
   - *Statewide Technical Architecture – Data Architecture* (Chapter 4) (Information Resource Management Commission – March 2000).

7. **Products:** The State of North Carolina shall make the draft and final Requirements Analysis documents available to the CTS Committee for review and comment. The final product of this Mapping Activity will be implementation of an operational information management system by the State of North Carolina.

8. **Schedule and Milestones:** The system design will be completed by March 30, 2001. The initial operable system will be implemented by September 30, 2001; some functions will be added later.

9. **Reporting:** Periodic reporting will be provided to the CTS Committee by the State of North Carolina for review and feedback.

10. **Points of Contact:** The FEMA Project Manager is Laura Algeo, and the CTS Program Director is John Dorman, or subsequent personnel of comparable experience who are appointed to fulfill these responsibilities.

Each party has caused this Mapping Activity Statement to be executed by its duly authorized representatives.

John K. Dorman, Program Director
North Carolina Office of State Budget, Planning and Management

05/15/01
Date

Laura Algeo, Project Manager
Federal Emergency Management Agency

07/16/01
Date

Doug Bellomo, Project Officer
Federal Emergency Management Agency

05/11/01
Date

State of North Carolina
Cooperating Technical State
Mapping Activity Statement

Agreement C—Digital Base Map Data for Six Eastern River Basins

In accordance with the Cooperating Technical State (CTS) Memorandum of Agreement dated September 15, 2000, between the State of North Carolina and the Federal Emergency Management Agency (FEMA), Agreement C is as follows:

1. **Objective and Scope:** The objective of this Mapping Activity is selection, acquisition, and preparation of the digital base map data that will be used in preparing Digital Flood Insurance Rate Maps (DFIRMs) for the counties and communities in the six eastern river basins in the State of North Carolina.

   The digital base map sources will include USGS Digital Orthophoto Quarter Quadrangles (DOQs), locally produced data sets, and selected features from the North Carolina Corporate Geographic Database. This activity will also include identification of available locally produced base maps and assessment of whether the locally produced base maps meet FEMA's DFIRM specifications. Information regarding locally available base maps and data sets will be gathered through a "GIS Data Availability Survey" conducted concurrently with the Project Scoping conducted under Mapping Activity Statement A. The results of this survey will be documented in a database.

   This activity will also include preparing the base maps for DFIRM production to be initiated under Mapping Activity Statement E. Base map preparation will entail determining tiling schemes (scale and paneling), integrating data from local sources into countywide coverages, redelineating hydrographic features, and adding appropriate labels (e.g., roads, streams, corporate limits).

   This activity will also include generating metadata required by the National Geospatial Data Clearinghouse. Base map data will be documented using the Content Standards for Digital Geospatial Metadata, and the metadata will be served through the North Carolina Geographic Data Clearinghouse and the National Geospatial Data Clearinghouse.

2. **Period of Performance:** This Mapping Activity will begin in November 2000 and will be completed by September 30, 2002. This Mapping Activity may be terminated at the option of FEMA or the State of North Carolina in accordance with the provisions of the September 15, 2000, CTS Memorandum of Agreement.

3. **Funding/Cost-Sharing:** Funding will be in accordance with CTS Funding Agreement No. 1.

4. **Standards:** The following standards and resource documents are relevant to the evaluation of digital base map data and this Mapping Activity:

- *Base Map Standards for New Digital Flood Insurance Rate Map Product* (Draft, May 26, 1999). This document provides minimum base map standards for DFIRMs and includes the following requirements for base map data:
  - cover the community(s) or county(s) completely;
  - can be distributed by FEMA to the public;
  - meet the minimum accuracy requirements outlined in the document; and
  - include all required features.
- Base maps will be tiled by the 10,000' x 10,000' State Plane grid tiling system for DFIRM production; scales for hardcopy DFIRM production will be 1"=1,000' or 1"=500'.
- *Standards for Digital Orthophotos* (U.S. Geological Survey, National Mapping Program, December 1996).
- *Content Standards for Digital Geospatial Metadata* (Federal Geographic Data Committee, 1998).
- *Open GIS Web Server Specifications* (Open GIS Consortium).

5. **Products:** The State of North Carolina shall produce base maps ready for DFIRM production under Mapping Activity Statement E.

6. **Schedule and Milestones:** This activity will be completed to allow the schedule and milestones established in Mapping Activity Statement E to be met.

7. **Certification:** The State of North Carolina will ensure that the digital base map data selected for DFIRM production meet FEMA's minimum standards and specifications for DFIRMs.

8. **Technical Assistance and Resources:** Updated DOQs and hydrographic data will be produced through partnering with the USGS. Specifically, the USGS will be asked to expedite completion of the production of DOQs based on 1998 aerial photography through the National Digital Orthophoto Program. The State will also work with the USGS to complete the joint effort to update the hydrographic data layer as part of the ongoing Surface Waters Project. These hydrogaphic data may be used to supplement existing hydrographic data outside of areas for which new flood hazard data are being developed under Mapping Activity Statement E.

   Additionally, through its Mapping Coordination Contractor, Dewberry & Davis LLC (MCC-D&D), FEMA will provide support in researching and evaluating available base maps and developing proposed tiling schemes (panel layout and scales) for DFIRM production. The MCC-D&D will develop a database to store the results of the GIS Data Availability Survey and will help populate the database. The MCC-D&D will also provide technical guidance regarding new or updated guidelines, standards, and requirements.

9. **Contractors:** Contractors may be used by the State of North Carolina to assist in the completion of the activity associated with this agreement. Contractors will be licensed to practice in the State of North Carolina as required by North Carolina General Statute 89C. Procurement of subcontractors using Federal funds provided as part of this Mapping Activity will comply with the requirements of 44 CFR 13.36 and NC G.S. 89C.

10. **Quality Assurance/Quality Control (QA/QC) Procedures:** The State of North Carolina will perform internal QA/QC on its digital base map data before initiating DFIRM production.

11. **Reporting:** Periodic reporting will be provided to the CTS Committee by the State of North Carolina for the purpose of review and approval.

12. **Points of Contact:** The FEMA Project Manager is Laura Algeo, and the CTS Program Director is John Dorman, or subsequent personnel of comparable experience who are appointed to fulfill these responsibilities.

Each party has caused this Mapping Activity Statement to be executed by its duly authorized representatives.

John K. Dorman, Program Director
North Carolina Office of State Budget, Planning and Management

05/15/01
Date

Laura Algeo, Project Manager
Federal Emergency Management Agency

07/16/01
Date

Doug Bellomo, Project Officer
Federal Emergency Management Agency

05/11/01
Date

State of North Carolina
Cooperating Technical State
Mapping Activity Statement

Agreement D—Digital Elevation Data Development for Six Eastern River Basins

In accordance with the Cooperating Technical State (CTS) Memorandum of Agreement dated September 15, 2000, between the State of North Carolina and the Federal Emergency Management Agency (FEMA), Agreement D is as follows:

1. **Objective and Scope:** The objective of this Agreement is to acquire digital topographic data of the six eastern river basins in the State of North Carolina using airborne Light Detection and Ranging (LIDAR). Variably spaced, bare-earth digital topographic data in ASCII point file format will be combined with imagery (either flown concurrently with the LIDAR data collection or obtained from existing digital orthophotos) to establish a Triangulated Irregular Network (TIN) to include selected breaklines to be used for hydraulic modeling. Uniformly spaced Digital Elevation Models (DEMs) will be generated in multiple file formats for hydrologic and hydraulic modeling and other State and County applications using ARC/INFO and other GIS software. The primary goal is to use these data for floodplain modeling and mapping for counties and communities in the six eastern river basins in accordance with Mapping Activity Statement E between the State of North Carolina and FEMA. This Mapping Activity Statement Agreement is for the six eastern river basins in the State of North Carolina: Lumber, Cape Fear, White Oak, Neuse, Tar-Pamlico, and Pasquotank.

2. **Period of Performance:** This Mapping Activity will begin in December 2000 and continue through March 31, 2002. This Mapping Activity Agreement may be terminated at the option of FEMA or the State of North Carolina in accordance with the provisions of the September 15, 2000, CTS Memorandum of Agreement.

3. **Funding/Cost-Sharing:** Funding will be in accordance with CTS Funding Agreement No. 1.

4. **Tasks:** The following tasks are to be performed by the State and/or its contractors:

   - Task 1: LIDAR Data Acquisition. The first task requires calibration of the LIDAR system; acquisition of the raw data (airborne GPS, inertial measuring unit, and last-return LIDAR data) of the specified geographic area suitable for ASCII point files and TIN and DEM requirements listed below; and verification that all data are complete and usable. The calibration shall include establishment of a test course at each airport used for data acquisition flights; data are to be collected over this course during each flight. Furthermore, data acquisition will include cross-flights sufficient to validate the LIDAR data and detect systematic errors for system calibration. Acquisition of supplemental imagery and/or first-return and intermediate-return LIDAR data is optional. A data file for each flight conducted will contain GPS time tags associated with the XYZ position of

the aircraft during the flight and the associated GPS quality factor for each position. The State's contractors will have the flexibility of developing flight plans to create the necessary point density to meet the posting and accuracy requirements specified below and minimize the occurrence of data voids or gaps in the data sets.

- Task 2: Generation of Bare-Earth ASCII Files. This task requires the post-processing of the LIDAR data and production of the bare-earth ASCII point file of XYZ coordinates. The State's contractors will perform automated and manual post-processing of the raw LIDAR data to remove laser points that impinged on bridges, buildings, dense non-penetrated vegetation, and other features that do not represent the bare earth. The contractors will then produce a bare-earth ASCII point file of orthometric heights with coordinates produced to the NAD83 horizontal datum, 1995 HARN adjustment, and the NAVD88 vertical datum. North Carolina State Plane coordinates will be used, and all horizontal and vertical coordinates will be in meters to three decimal places.

- Task 3: Generation of TIN and Breaklines. This task requires the creation of a TIN (ESRI TIN format) to include supplemental breaklines (ESRI breakline coverage as 3-D points, lines, or polygons) that form additional TIN edges. For the breaklines, the State will use available imagery to establish edge of water lines and approximate location of breaklines at the tops and bottoms of major stream banks to enable hydraulic modeling of the stream channel geometry. This data set will be in ESRI TIN format because ESRI's ARC/INFO is commonly used for semi-automated hydraulic modeling. Successful completion of Task 3 is contingent on acceptance of the TIN by the North Carolina Geodetic Survey (NCGS). Before the TIN is accepted for hydraulic modeling, its accuracy will be independently assessed by the NCGS to ensure that accuracy standards have been satisfied and to ensure the data are suitable for hydraulic modeling. This assessment may dictate the reprocessing of data and/or supplemental data acquisition.

- Task 4: Development of DEMs in ESRI Grid Format. This task requires the production of a uniformly spaced 5m x 5m DEM (in ESRI GRID Float format) suitable for hydrologic modeling and diverse requirements of the State and counties.

- Task 5: Development of DEMs in Three Additional File Formats. Once the DEM grid has been cleaned of artifacts, other 5m x 5m uniformly spaced DEMs will be produced for non-ESRI product users in three additional file formats: (1) ASCII point file format (State Plane coordinates); (2) ASCII point file format (UTM coordinates); and (3) BIL file format (State Plane coordinates).

- Task 6: Preparation of Project Report. Task 6 requires the preparation of a Project Report for each river basin that documents the mission dates, times, flight altitude, airspeed, flight lines, scan angle, scan rate, laser pulse rates, weather conditions, and other information deemed pertinent in accordance with Table A4B-1 of Appendix 4B to FEMA 37 (www.fema.gov/mit/tsd/lidar_4b.htm). In the Project Reports, the State contractors must provide evidence that the total LIDAR system was regularly calibrated for the purpose of identifying and correcting systematic errors. The reports must explain how calibration was checked or validated during the duration of the data acquisition phase by using the test course and cross-flights and explain how calibration

data were used in post-processing. The reports will also explain procedures used for post-processing and generation of TINs, breaklines, and DEMs; difficulties encountered; and steps taken to resolve discrepancies.

5. **Standards:**

- The LIDAR data are to be acquired during leaf-off and favorable weather conditions to produce a bare-earth TIN to be used for hydraulic modeling and bare-earth DEMs, in multiple file formats, to be used for hydrologic modeling and other State and County activities. Data should not be acquired during flooding conditions or with snow, other than a light dusting; low-water conditions are highly desirable but not mandatory.

- A bare-earth ASCII point file represents variably spaced LIDAR reflections from the ground or from low vegetation on the ground, and not from a vegetation canopy or structures. The bare-earth ASCII point file from Task 2 and the resultant TIN from Task 3 should have a vertical accuracy of 40 cm or better at the 95% confidence level for coastal counties, and 50 cm or better for non-coastal counties. To achieve this vertical accuracy, consistent with the National Standard for Spatial Data Accuracy, the ASCII point file and TIN should have a vertical RMSE of 20 cm or less for coastal counties and 25 cm or less for non-coastal counties in each of the major vegetation categories within the floodplain being studied, after correction for systematic errors.

- To check the vertical accuracy of the TIN in accordance with Appendix 4B of FEMA 37, "Airborne Light Detection and Ranging Systems," the NCGS will perform an independent accuracy assessment of the bare-earth TIN for each county by selecting and surveying a minimum of 20 check points in each of three or more major vegetation categories that predominate within the floodplain being studied. Check points will be selected on terrain that is flat or of uniform slope for 5 meters in all directions, avoiding check points that are near breaklines with changing slope. Check points will be surveyed by combination of GPS and conventional surveys as necessary to establish check points in the interior of forested areas. TIN linear interpolation will be used by the NCGS to compare surveyed elevations with interpolated elevations from surrounding TIN points. The NCGS will discard no more than 5% of check points in the RMSE calculations to account for uncleaned artifacts. If RMSE values exceed 20 cm in coastal counties or 25 cm in non-coastal counties for any of the vegetation categories, an assessment will be made by the NCGS, in coordination with FEMA, to determine if the data are usable for their intended purpose, or if additional steps are necessary to produce an acceptable data set.

- The DEMs in all file formats (Tasks 4 and 5) will have uniform 5-meter point spacing where horizontal State Plane coordinates are whole-meters ending with 0 or 5; the horizontal datum is NAD83, 1995 HARN adjustment. Vertical coordinates are in meters to three decimal places; the vertical datum is NAVD88.

6. **Schedule and Milestones:** The following sequential tasks will be undertaken to develop the TINs and DEMs needed for hydrologic and hydraulic modeling and floodplain mapping:

- LIDAR data acquisition

- Generation of bare-earth ASCII files
- Generation of TIN and breaklines
- Development of DEMs in ESRI Grid (State Plane) format
- Development of DEMs in ASCII Point File (State Plane and UTM) and BIL (State Plane) formats
- Preparation of basin Project Reports

The TINs shall be completed by April 1, 2001, for the Lumber, White Oak, and Tar-Pamlico River basins and by June 30, 2001, for the Cape Fear, Neuse, and Pasquotank River basins. The DEMs in all file formats and final Project Reports shall be completed by May 1, 2001, for the Lumber, White Oak, and Tar-Pamlico River basins and by July 31, 2001, for the Cape Fear, Neuse, and Pasquotank River basins.

7. **Certification:** A Professional Engineer or Licensed Land Surveyor will certify topographic information, in accordance with 44 CFR 65.5(c) and North Carolina General Statute 89C.

8. **Technical Assistance and Resources:** FEMA's Mapping Coordination Contractor, Dewberry & Davis LLC, will provide technical assistance in developing contractor Delivery Order proposal requests, setting up control networks, assessing DEM data accuracy, and merging ground surveys with remote sensing data to fill data voids. FEMA will provide the State of North Carolina any new or updated guidelines, standards, and requirements associated with both contract work and programmatic direction.

   The NASA Office of Earth Science may provide an independent LIDAR test strip, from the North Carolina border with South Carolina to the border with Virginia, that runs through all six basins. As envisioned, this strip would be flown and post-processed by the U.S. Army Topographic Engineering Center to produce a strip of bare-earth elevation points. This would be an optional bonus tool for assessing the accuracy of the LIDAR data, as opposed to a mandatory requirement.

9. **Contractors:** Contractors will be used by the State of North Carolina for this activity. Contractors will be licensed to practice in the State of North Carolina as required by North Carolina General Statute 89C. Independent contractors will be used by the State of North Carolina to assist in the acquisition of topographic data and in QA/QC.

10. **Quality Assurance/Quality Control (QA/QC) Procedures:** The NCGS will conduct control surveys using differential GPS and traditional survey techniques to ensure the accuracy of the TIN data, as described under the "Standards" section of this Agreement.

11. **Reporting:** Regular progress reports will be provided during CTS Committee meetings. The final Project Report prepared by the State's contractor(s) will also be provided to the CTS Committee for review and concurrence.

12. **Points of Contact:** The FEMA Project Manager is Laura Algeo, and the CTS Program Director is John Dorman, or subsequent personnel of comparable experience who are appointed to fulfill these responsibilities.

Each party has caused this Mapping Activity Statement to be executed by its duly authorized representatives.

John K Dorman — 05/25/01

John K. Dorman, Program Director
North Carolina Office of State Budget, Planning, and Management — Date

Laura Algeo — 07/16/01

Laura Algeo, Project Manager
Federal Emergency Management Agency — Date

05/11/01

Doug Bellomo, Project Officer
Federal Emergency Management Agency — Date

State of North Carolina
Cooperating Technical State
Mapping Activity Statement

Agreement E—Updated Flood Hazard Data and Digital FIRM Production for Six Eastern River Basins

In accordance with the Cooperating Technical State (CTS) Memorandum of Agreement dated September 15, 2000, between the State of North Carolina and the Federal Emergency Management Agency (FEMA), Agreement E is as follows:

1. **Objective and Scope:** The objective of this Mapping Activity is for the State of North Carolina to develop updated flood hazard data for the six eastern river basins (Lumber, Cape Fear, White Oak, Neuse, Tar-Pamlico, and Pasquotank) and use those data to produce Digital Flood Insurance Rate Maps (DFIRMs) for the affected counties and communities.

   As a result of the "Project Scoping for Six Eastern Basins" conducted under Mapping Activity Statement A, Basin Plans documenting the flooding sources to be updated and methodologies to be used will be developed. The Basin Plans will also document the countywide DFIRMs to be produced using these updated flood data. As such, the final Basin Plans issued by the State and FEMA to the affected counties and communities will become official attachments to this Mapping Activity Statement.

   Additionally, DEMs developed as part of Mapping Activity Statement D, "Digital Elevation Data Development," will be used for modeling coastal and riverine hazards and delineating floodplains under this Agreement. Further, field surveys will be conducted as part of this Agreement for flooding sources to be studied in detail to obtain channel and structure geometry and bathymetry and integrated into the DEMs for engineering modeling. All topographic and flood elevations will be referenced to North American Vertical Datum of 1988 (NAVD88).

   Base maps identified as meeting FEMA's DFIRM specifications under Mapping Activity Statement C, "Digital Base Map Data," will be used for DFIRM production under this Agreement. The DFIRMs will be produced in countywide format whereby the unincorporated areas of the county and incorporated communities within the county are shown on the same set of maps.

   For flooding sources that will be redelineated, cross sections and floodway boundaries will be digitized from the currently effective FIRMs and merged with the new flood hazard data for updated flooding sources. BFEs for such areas will be referenced to National Geodetic Vertical Datum of 1929 will be converted to NAVD88. Additionally, effective Letters of Map Change (LOMCs) will be reflected in the DFIRMs, as appropriate.

2. **Period of Performance:** This Mapping Activity will begin in January 2001 and be completed by August 2003. It is anticipated that preliminary countywide DFIRMs will be issued for counties in the Lumber, White Oak, and Tar-Pamlico River basins around September 2001 and for the Cape Fear, Neuse, and Pasquotank River basins around September 2002. Further, it is planned that post-preliminary processing (community review, statutory 90-day appeal period,

and a compliance period) will be completed and final effective DFIRMs printed and distributed for counties in the Lumber, White Oak, and Tar-Pamlico River basins by September 2002 and for the Cape Fear, Neuse, and Pasquotank River basins by September 2003.

This Mapping Activity may be terminated at the option of FEMA or the State of North Carolina in accordance with the provisions of the September 15, 2000, CTS Memorandum of Agreement.

3. **Funding/Cost-Sharing:** Funding will be in accordance with CTS Funding Agreement No. 1.

4. **Standards:** Unless otherwise indicated in a specific final Basin Plan, the following standards will be met in completing this Mapping Activity:

- Elevation data for surveys, engineering analyses, and DFIRM production will be referenced to the NAVD88.
- Field surveys of structure geometry and bathymetry will be conducted in accordance with Appendix 4 of FEMA 37, *Guidelines and Specifications for Study Contractors* (January 1995). (FEMA 37 is available at FEMA's Web site at http://www.fema.gov/mit/tsd/EN_reg.htm).
- Detailed hydrologic and hydraulic analyses and floodplain mapping will follow the standards set forth in Chapters 4 and 5 of FEMA 37 and Title 44 of the Code of Federal Regulations (CFR), Part 65.
- The floodway will be established in accordance with 44 CFR 65.7, as well as any applicable state and local requirements.
- Riverine flood elevations and floodplain and floodway delineations will reasonably tie in to non-revised information in accordance with 44 CFR 65.6(a)(6). Flood elevations and floodplain and floodway delineations will also reasonably tie in between adjacent flooding sources and contiguous counties.
- Detailed coastal analyses and floodplain mapping will follow the standards set forth in Appendices 1, 1A, 1B, and 1C of FEMA 37 (as applicable) and FEMA's *Guidelines and Specifications for Wave Elevation Determination and V Zone Mapping* (final draft March 1995).
- Computer models used for hydrologic, hydraulic, and/or coastal analyses will meet the requirements of 44 CFR 65.6(a)(6) and be on FEMA's *Numerical Models Accepted by FEMA for NFIP Usage* (http://www.fema.gov/mit/tsd/EN_modl.htm).
- Coastal flood elevations and floodplain delineations will reasonably tie in to non-revised information in accordance with 44 CFR 65.6(a)(6). Flood elevations and floodplain delineations will also reasonably tie in between adjacent flooding sources and contiguous counties.
- Any levee or dike systems to be shown on the community's FIRM as providing protection from the 1% annual chance flood will comply with the requirements of 44 CFR 65.10. Chapter 7 of FEMA 37 provides guidelines for evaluating levee systems.
- Digital Elevation Models based on LIDAR data obtained under Mapping Activity Statement D, "Digital Elevation Data Development," and field surveys conducted under this Agreement will be used for delineating the floodplains and will comply with the requirements of Appendix 4 of FEMA 37.
- DFIRM production will comply with *Digital Flood Insurance Rate Map (DFIRM) Graphic Specifications* and the standard DFIRM spatial database product description. Modifications to these specifications that are specific to the North Carolina Flood Mapping Program will

also be provided by or approved by FEMA. Any modifications will not need to be applied retroactively.

- FEMA and the State of North Carolina are using digital procedures to determine and show BFEs in Zone A areas on the DFIRMs. BFEs that have been determined based on these digital procedures will be shown on the FIRM as Zone AE BFEs.
- Data development will comply with *Standards for Digital Orthophotos* (U.S. Geological Survey, National Mapping Program, December 1996).
- Data development will comply with *Content Standards for Digital Geospatial Metadata* (Federal Geographic Data Committee, 1998).

5. **Products:** The State of North Carolina will make the following products available to FEMA:
   - Updated flood hazard data and modeling in accordance with Chapter 11 of FEMA 37 in the Technical Support Data Notebook (TSDN) format. These include:
     - Digital 1% and 0.2% annual chance floodplain boundaries and floodway;
     - Digital profiles of the 10%, 2%, 1%, and 0.2% annual chance water-surface elevations, representing existing conditions, for riverine flooding sources studied by detailed methods of analysis;
     - Floodway data tables and summary of discharges tables for riverine flooding sources studied by detailed methods of analysis;
     - Transect summary tables for coastal flooding sources studied by detailed methods of analysis;
     - Digital copies of all hydrologic, hydraulic, and coastal modeling (input and output files); and
     - Any other back-up computations and data used in the analyses or mapping.
   - Draft preliminary DFIRMs (including base maps) for each affected county for community review and comment and to provide the basis for the statutory appeal period as per Part 67 of 44 CFR.
   - Final DFIRM mapping files in one of the GIS file formats specified in FEMA's *Digital Flood Insurance Rate Map (DFIRM) Graphic Specifications*.
   - Final DFIRM database files. These files will include the required information and follow the examples shown in FEMA's standard DFIRM spatial database product description. Metadata files will be provided describing the DFIRM data; these files will comply with *Content Standards for Digital Geospatial Metadata* (Federal Geographic Data Committee, 1998).

   Additionally, after peer review has been performed, FEMA will provide the State with a summary report that includes a description and the results of all reviews. This report will contain suggested resolutions to any problems detected during the reviews.

6. **Schedule and Milestones:** The development of updated flood hazard data and production of DFIRMs will follow the process in Attachment A, "North Carolina Floodplain Mapping Program Production Process." As shown in the flowchart, many of the steps will be completed concurrently. The State and FEMA will continually evaluate and optimize the process with the goal of reducing turnaround times to complete engineering studies and produce updated DFIRMs. The specific schedules for each milestone for each river basin and county will be specified in the final Basin Plans.

7. **Certification:** The following certifications apply to this Mapping Activity:
   - A Professional Engineer or Licensed Land Surveyor will certify the TSDN and all hydrologic, hydraulic, and coastal analyses and data, in accordance with the North Carolina General Statute (NCGS) 89C and 44 CFR 65.6(f).
   - A Professional Engineer or Licensed Land Surveyor will certify topographic information in accordance with NCGS 89C and 44 CFR 65.5(c).
   - Any levee systems to be accredited as discussed in Section 4 of this Mapping Activity Statement will be certified in accordance with NCGS 89C and 44 CFR 65.10(e).

8. **Technical Assistance and Resources:** FEMA, as part of its in-kind contribution, will provide independent review of intermediate data, analyses, and products through its Mapping Coordination Contractor, Dewberry & Davis LLC (MCC-D&D). Additionally, FEMA will be responsible for post-preliminary processing, including resolution of appeals and protests. Additionally, FEMA and the MCC-D&D will provide ongoing technical support, as needed, to the State of North Carolina in completion of this activity.

   FEMA will provide the State of North Carolina any new or updated guidelines, standards, and requirements associated with both contract work and programmatic direction.

9. **Contractors:** Contractors will be used by the State of North Carolina to assist in the completion of the activity associated with this Agreement. Contractors will be licensed to practice in the State of North Carolina as required by NCGS 89C. Procurement of subcontractors using Federal funds provided as part of this Mapping Activity will comply with the requirements of 44 CFR 13.36.

10. **QA/QC Procedures:** The State of North Carolina will be responsible for ensuring that its contractors perform adequate review for quality assurance and quality control to ensure that products submitted to FEMA comply with the standards listed above. Additionally, as part of FEMA's in-kind contribution to the State's mapping program, the flood data and modeling and DFIRM data prepared for this Mapping Activity will be peer reviewed by FEMA and/or the MCC-D&D. Any anomalies or concerns will be brought to the State's attention for discussion and resolution. These peer reviews will occur at intermediate points during production, as shown on the flow chart included as Attachment A.

11. **Reporting:** Periodic reporting will be provided to the CTS Committee by the State of North Carolina for review and feedback.

12. **Points of Contact:** The FEMA Project Manager is Laura Algeo, and the CTS Program Director is John Dorman, or subsequent personnel of comparable experience who are appointed to fulfill these responsibilities.

Each party has caused this Mapping Activity Statement to be executed by its duly authorized representatives.

John K. Dorman, Program Director
North Carolina Office of State Budget, Planning and Management

07/25/01
Date

Laura Algeo, Project Manager
Federal Emergency Management Agency

7/27/01
Date

Doug Bellomo, Project Officer
Federal Emergency Management Agency

07/20/01
Date

Modification A to Funding Agreement No. 1
Statement of Work
North Carolina Flood Mapping Program
Initial Phase

Purpose

This document modifies Funding Agreement No. 1 between the State of North Carolina and the Federal Emergency Management Agency. Funding agreement No. 1 was signed on September 18, 2000 and summarized the then-available funding sources and amounts for the Initial Phase of the State of North Carolina Flood Mapping Program. This Initial Phase will result in updated flood data and digital Flood Insurance Rate Maps (DFIRMs) for the counties and communities in the six eastern river basins in the State. This Initial Phase will also include design, development, and implementation of a dynamic, state-of-the art Information Technology (IT) system to analyze, maintain, archive, and disseminate the flood maps and associated flood hazard data.

Background

The State of North Carolina, through FEMA's Cooperating Technical Partner (CTP) initiative, has been designated as a Cooperating Technical State (CTS). As a CTS, the State will conduct flood hazard analyses to produce updated DFIRMs and assume primary ownership and responsibility of DFIRMs for all North Carolina communities.

The North Carolina Flood Mapping Program includes the acquisition, processing, and dissemination of current, accurate, and detailed elevation data, flood hazard studies, and maps for all 17 river basins in North Carolina. In the Initial Phase, the State plans to complete six of the 17 river basins, which comprises approximately half of the State. These river basins include:

- Lumber
- Cape Fear
- White Oak
- Neuse
- Tar-Pamlico
- Pasquotank

The State and FEMA, as well as other Federal Agency partners, signed an overall Memorandum of Agreement to collaborate on the State's flood mapping program on September 15, 2000. Further, the State and FEMA have identified specific tasks to undertake and are in the process of developing Mapping Activity Statement (MAS) agreements. These MAS agreements define the roles, responsibilities, and resources being committed to accomplishing these tasks by North Carolina, FEMA, and other Federal Agencies. The MAS agreements also specify the applicable standards for conducting hazard analyses and developing the maps and associated products.

For the Initial Phase of the North Carolina Flood Mapping Program, the following MAS agreements have been developed:

Agreement	Title
A	Project Scoping for Six Eastern Basins
B	Digital Data Management
C	Digital Base Map Data for Six Eastern Basins
D	Digital Elevation Data Development for Six Eastern Basins
E	Updated Flood Hazard Data and Digital FIRM Production for Six Eastern Basins
F	Technology and Data Standards

Mapping Activity Statement A was signed and executed by the State of North Carolina and FEMA on January 9, 2001. MAS B, C, and D were signed and executed on July 15, 2001. Also, MAS E is in the process of being signed.

Funding Agreement No. 1 and this modification pertain only to the MAS agreements specified in the table above.

Performance Period

All products defined under this acquisition shall be completed by the end of Federal Fiscal Year 2002 (September 30, 2002).

Scope

The work covered under Funding Agreement No. 1 (as amended by this modification) and the MAS agreements specified above can be broken into three components: (1) Engineering and Mapping (2) Design and Implementation of an IT System; and (3) Map Production Coordination. These components were summarized in Funding Agreement No. 1.

Funding

The total cost for components 1 and 2 of the Initial Phase of the State's program is estimated to be $38 million. Under Funding Agreement No. 1, the State allocated $23.2 million toward this effort. Additionally, the State allocated $5 million from the allowable management costs from Federal disaster relief funding (provided pursuant to the Stafford Act for Hurricane Floyd recovery) for the flood mapping effort. The updated engineering studies and DFIRMs will help administer and guide Hurricane Floyd recovery activities. Also under Funding Agreement No. 1, FEMA obligated $1 million from its FY 2000 Flood Mapping budget for this effort. This $1 million was specifically designated for activities defined under Mapping Activity Statement E.

Under this modification to Funding Agreement No. 1, the State of North Carolina is obligating an additional $1.0 million and FEMA is obligating $1.0 million from its FY 2001 Flood Mapping Budget. This $1 million from FEMA is also specifically designated for activities defined under Mapping Activity Statement E. This brings the total available funding for

components 1 and 2 of the Initial Phase of the North Carolina Flood Mapping Program to $31.20 million as shown in the table below.

Funding Source	Amount Available
Funding Agreement No. 1	$29.20 million
State of North Carolina	$23.20 million
FEMA- Disaster Relief Funding	$ 5.00 million
FEMA- FY 2000 Flood Mapping Budget	$ 1.00 million*
Modification	$ 2.00 million
State of North Carolina	$ 1.00 million
FEMA- FY 2001 Flood Mapping Budget	$ 1.00 million*
Total for Components 1 and 2 of Initial Phase of North Carolina Flood Mapping Program	$31.20 million

* Specifically for activities defined under Mapping Activity Statement E

As funding from other CTS Federal Agency Partners is obtained, modifications to this funding agreement will be issued.

The State has the discretion to allocate this funding for specific tasks for the project, provided that the work performed complies with the requirements stated within the referenced MASs. Additionally, this funding may be used by the State of North Carolina to contract with private engineering, land surveying, and/or aerial surveying firms for necessary professional services to complete project tasks. Procurement of such contractors shall comply with the requirements of Section 13.36 of Title 44 Code of Federal Regulations and North Carolina General Statute 89C.

Component 3 (Map Production Coordination) of the Initial Phase will be completely funded by FEMA.

Each party has caused this Funding Agreement to be executed by its duly authorized representatives.

John Dorman

John Dorman, NC OSBPM

7/26/01

date

A. Todd Davison, FEMA

7/27/01

date